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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/352,362	07/13/1999	SHUNPEI YAMAZAKI	0756-1996	2149

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EXAMINER

DIAZ, JOSE R

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 07/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/352,362

Applicant(s)

YAMAZAKI ET AL.

Examiner

José R. Díaz

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 15-24, 28, 30-115 and 123-178 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 15-24, 28, 30-115 and 123-178 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>5/3/04</u> . | 6) <input checked="" type="checkbox"/> Other: <u>Clean copy IDS 12/8/01</u> . |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 3, 2004 has been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 22-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Yamazaki et al. (JP 10-1035469).

Regarding claim 22, Yamazaki et al. teach a method comprising the steps of:

adding an element (106) for facilitating crystallization of an amorphous semiconductor thin film (103) (see Fig. 1B);

carrying out a first heat treatment (1st heat treatment) to transform the amorphous semiconductor thin film into a crystalline semiconductor thin film (see Fig. 1C and paragraph [0041]);

carrying out a second heat treatment of irradiating a ultraviolet light ("excimer laser") to said crystalline semiconductor thin film (see paragraph [0045]);

carrying out a third heat treatment in a reducing atmosphere including halogen element (HCl) after the second heat treatment (see paragraphs [0049] and [0052]).

Regarding claim 23, Yamazaki et al. teaches that the second heat treatment is carried out at a temperature of 900 to 1200 °C (see paragraph [0064]).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claim 15-21, 24, 28, 30-115 and 123-178 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamazaki et al. (JP 10-1035469) in view of Sato et al. (US Pat. No. 5,869,387).

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Regarding claims 15, 17, 20, 28, 30-35 and 177-178, Yamazaki et al. teaches a method of fabricating a semiconductor device comprising:

adding an element (nickel acetate solution) for facilitating crystallization of an amorphous semiconductor thin film (103) to a part or an entire region of the amorphous semiconductor thin film (see fig. 1B and paragraphs [0039] and [0040]);

carrying out a first heat treatment (1st heat-treatment) to transform the part or the entire region of the amorphous semiconductor thin film into a crystalline semiconductor thin film (107) (see Fig. 1C and paragraph [0041]);

irradiating a laser light ("excimer laser") to said crystalline semiconductor thin film (see paragraph [0045]); and

carrying out a second heat treatment for the crystalline semiconductor thin film at 900 to 1200 °C in a reducing atmosphere (nitrogen atmosphere) after the irradiation of said laser light (see paragraph [0064]),

wherein asperities ("irregularity") of a surface of said crystalline semiconductor thin film are formed by said laser light (laser annealing) (paragraph [0045]).

In addition and with regards to claim 20, Yamazaki et al. further teaches that the second heat treatment comprises the step of irradiating an ultraviolet light ("excimer laser") to said crystalline semiconductor thin film (see paragraph [0045]). With regards to claim 32, Yamazaki et al. further teaches the limitation of etching a surface of the crystallized semiconductor film (107) after the irradiation of said laser light to remove an oxide therefrom (see fig. 1D and paragraph [0046]). And with regards to claim 33, Yamazaki et al. further teaches the steps of treating a surface of the crystallized semiconductor film with hydrofluoric acid after the irradiation of said laser light to

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remove an oxide therefrom (see paragraph [0052]); and heating the crystallized semiconductor film in a reducing atmosphere (nitrogen) after said treating step (see paragraph [0064]).

With regards to the claimed order of method steps, it would have been obvious to one of ordinary skill in the art, since it has been held that selection of any order of performing process steps is *prima facie* obvious in the absence of new or unexpected results. *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946).

However, Yamazaki et al. is silent with respect to the limitation that said asperities are flattened by said second heat treatment. Sato et al. teaches that it is well known in the art to treat a monocrystalline semiconductor film in a nitrogen atmosphere at a temperature of about 1200 °C (col. 1, lines 45-52) or alternatively in a reducing atmosphere comprising hydrogen at a temperature of less than about 1200 °C (col. 38, lines 16-25 and 40-43).

Yamazaki et al. and Sato et al. are analogous art because they are from the same field of endeavor as applicant's invention. At the time of the invention it would have been obvious to a person of ordinary skill in the art to include a heating treatment in a reducing atmosphere to flat the asperities or roughness of a surface of the crystallize semiconductor film. The motivation for doing so, as is taught by Sato et al., is producing monocrystal layer with excellent crystallinity (col. 5, lines 31-33 and 61-64). Therefore, it would have been obvious to combine Sato et al. with Yamazaki et al. to obtain the invention of claims 15-21, 24, 28, and 30-41.

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Regarding claims 16, 19, 21, 24, Yamazaki et al. fails to teach a concentration of oxygen or an oxide compound is not higher than 10 ppm. However, it would have been obvious to one of ordinary skill in the art, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. The ordinary artisan would have been motivated to modify Yamazaki et al. in the manner described above for at least the purpose of improving the reliability of the semiconductor device.

Regarding claim 18, Yamazaki et al. teaches that the second heat treatment is carried out at a temperature of 900 to 1200 °C (see paragraph [0064]).

Regarding claims 36-41, Sato et al. teaches that it is well known in the art to carry out the heating step on a furnace annealing (col. 18, lines 24-26).

Regarding claims 42-45, Sato et al. teaches that the heating step is carried out while exposing the semiconductor film (col. 18, lines 24-26 and 31-33).

Regarding claims 46, 53, 56, 60, 63, 67, 74, and 81, Yamazaki et al. teaches that the crystallizing step is carried out in an inactive atmosphere ("inert atmosphere") (see paragraph [0041]).

Regarding claims 47, 54, 61, 68, 70, 75, 77, 82, and 84, Yamazaki et al. teaches that the crystallizing step is carried out in an atmosphere containing hydrogen (see paragraph [0041]).

Regarding claims 55, 62, 69, 76, and 83, Yamazaki et al. teaches that the crystallizing step is carried out in an atmosphere containing oxygen (see paragraph [0038]).

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Regarding claims 52, 57, 59, 64, 66, 71, 73, 78, 80, 85, and 87, Yamazaki et al. teaches that the crystallizing step is carried out by irradiating an UV light to said semiconductor film (see paragraph [0038]).

Regarding claims 89-108 and 123-171, Yamazaki et al. teach that the semiconductor device is a video camera, a digital camera, a projector, a head mount display, a car navigation system, a personal computer, a portable information terminal (see figure 16).

Regarding claims 172-176, Yamazaki et al. teaches patterning the crystalline semiconductor (110) and forming a gate insulating film (111) (see figure 1D). With regards to the claimed order of method steps, it would have been obvious to one of ordinary skill in the art, since it has been held that selection of any order of performing process steps is *prima facie* obvious in the absence of new or unexpected results. *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946).

Double Patenting

7. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

8. Claims 15-24, 28, 30-115 and 123-178 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-66 of U.S. Patent No. 6,559,036 B1¹. Although the conflicting claims are not identical, they are not patentably distinct from each other because U.S. Patent No. 6,559,036 B1 essentially recites all claimed feature. For example, claim 15 of application number 09/352,362 recites the following steps which correspond to various steps in claim 9 of U.S. Patent No. 6,559,036 B1:

(a) adding an element for facilitating crystallization of an amorphous semiconductor thin film to a part or an entire region of the amorphous semiconductor thin film;

(b) carrying out a first heat treatment to transform the part or the entire region of the amorphous semiconductor thin film into a crystalline semiconductor thin film

(c) irradiating a laser light to said crystalline semiconductor thin film

Claim 11: adding an element including nickel.

Claim 10, lines 3-5: wherein the step include crystallizing an amorphous or "noncrystal-containing" semiconductor film.

Claim 9, lines 60-62: "laser annealing treatment."

¹ Please note that U.S. Application 09/369,158 was patented as U.S. Patent 6,559,036. Thus, the previous double patenting rejection was updated to include the new status of the U.S. Application.

(d) carrying out a second heat treatment for the crystalline semiconductor thin film at 900 to 1200 °C in a reducing atmosphere after the irradiation of said laser light

(e) wherein asperities of a surface of said crystalline semiconductor thin film are formed by said laser light, and said asperities are flattened by said second heat treatment.

Claim 9, lines 65-67: "furnace annealing treatment at 900 to 1200 °C in a reducing atmosphere."

Although this limitation is not explicitly claimed in the Patent, it is very well known in the art that irradiation of a laser light inherently forms asperities on a treated surface. Also, it is noted that the reducing atmosphere recited in claim 15 is the same atmosphere disclosed by applicant, hence it is inherent that the asperities are flattened by the second heat treatment. In addition, it is further noted that U.S. Patent No. 6,559,036 B1 disclosed the flattening effect in column 3, lines 8-11.

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9. Claim 15-16, 20-21, 28, 30-115 and 123-178 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-77 of copending Application No. 10/081,767 in view of Sato et al. (US Pat. No. 5,869,387).

Claims 15-16, 20-21, 28, 30-31, 34-35, 42-48, 53-55, 60-62, 67-69, 74-76, 81-83 and 177-178 of the present Application recite the steps of: adding an element for facilitating crystallization of an amorphous layer (which is recited in claims 6-8 of the copending Application); performing a first heat treatment (which is recited in claims 6-8 of the copending Application); irradiating a laser light (which is recited in claims 6-8, 9, 27, 38, 49, 54 and 66 of the copending Application); and carrying out a second heat treatment in a reducing atmosphere (which is recited in claims 6-8 of the copending Application). With regards to the claimed temperature range of 900 °C to 1200 °C, claims 4-5 of the copending Application recites the limitation of performing the second heat treatment at such temperature range.

In addition, claims 6-8 of the copending Application is silent with respect to the reducing atmosphere. However, Sato et al. teaches that it is well known in the art to treat a monocrystalline semiconductor film in a nitrogen atmosphere at a temperature of about 1200 °C (col. 1, lines 45-52) or alternatively in a reducing atmosphere comprising hydrogen at a temperature of less than about 1200 °C (col. 38, lines 16-25 and 40-43). Therefore, it would have been obvious to one having ordinary skill in the art at the same time the invention was made to modify the copending Application to include a reducing atmosphere comprising nitrogen or hydrogen. The ordinary artisan would have been motivated to modify the copending Application in the manner described above for at least the purpose of flattening the surface of the substrate.

Claims 32 and 33 of the present Application recite the further step of etching the crystallized semiconductor film after the step of irradiating the film. This additional limitation can be found in claim 8 of the copending Application.

Claims 36-41 of the present Application recite the further limitation that said heating step is carried out by furnace annealing. This additional limitation can be found in claims 11, 17, 29, 40, 56, and 68 of the copending Application.

Claims 49-52, 56-59, 63-66, 70-73, 77-80, 84-87 of the present Application recite the further limitation that the crystallizing step is carried out by irradiating an infrared light and/or ultraviolet light. This additional limitation can be found in claims 9-12, 15, 17-18, 21, 27-30, 32-33, 38-41, 44, 49-50, 54-57, 60, and 66-69 of the copending Application.

Claims 88-115 and 123-176 of the present Application recite the further limitation that the semiconductor device is a video camera, a digital camera, a projector, a head mount display, a car navigation system, a personal computer, and a portable information terminal. This additional limitation can be found in claims 26, 37, 48, 53, 65, and 77 of the copending Application.

This is a provisional obviousness-type double patenting rejection.

Response to Arguments

10. Applicant's arguments filed May 3, 2004 have been fully considered but they are not persuasive in view of the new cited reference Sato et al. (US Pat. No. 5,869,387). See rejections above. Please note that claims 22-23 are still anticipated by Yamazaki et al. (JP 10-1035469) since Yamazaki et al. explicitly teaches the required reducing atmosphere including a halogen element (see paragraph [0049]). In addition, the double

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patenting rejection based on Ohtani et al. (U.S. Patent No. 6,559,036 B1) is still proper since Ohtani et al. claims the required method steps of irradiating a laser light and carrying out a heat treatment in a reducing atmosphere which inherently form the required smooth crystalline surface. Further, the provisional double patenting rejection based on copending Application No. 10/081,767 is further explained in view of the Sato et al. reference. Therefore, the rejections are considered to be proper.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to José R. Díaz whose telephone number is (571) 272-1727. The examiner can normally be reached on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JRD
7/26/04


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